

Investigating Nanoscale Structures of MnGa/GaAs and Mn/GaAs Digital-layers by X-Ray Methods

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Grazing incidence x-ray scattering (GIXS) and x-ray diffraction (XRD) techniques have been employed to study the microscopic structure of magnetic digital-layers of MnGa/GaAs and Mn/GaAs. Samples with various GaAs layer thickness (8 to 16 monolayers) were prepared by low-temperature molecular beam epitaxy and a monolayer of either MnGa or Mn was grown on top of GaAs forming the structure of a heterojunction. The digital-layer is a superlattice consisting of a total of 50 periods of these heterojunctions. The interface between MnGa (or Mn) and GaAs is believed to play an important role in affecting the transport and magnetic properties of these semiconductors. High crystalline quality was verified by XRD while the periodicity was clearly revealed from the GIXS data. The local structure and valency around Mn ions were also investigated by using extended x-ray absorption fine structure (EXAFS) and near-edge x-ray absorption fine structure (NEXAFS) techniques. These digital-layers are important contenders for the development of new spintronics technology.

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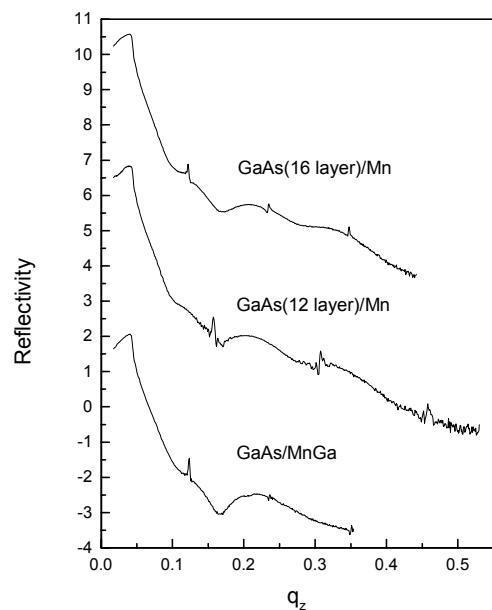


Figure 1. GIXS

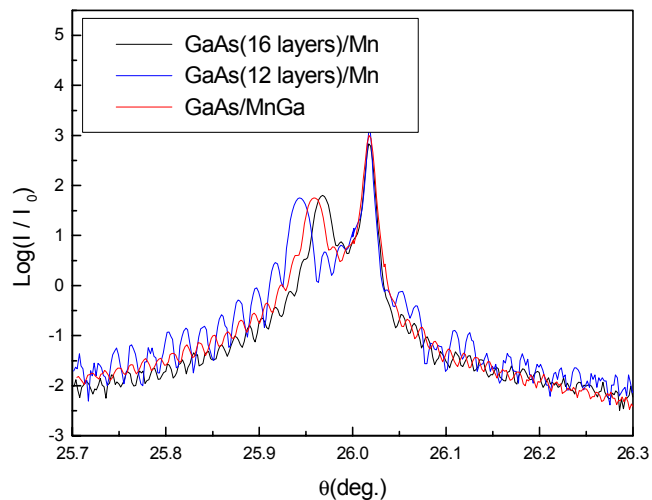


Figure 2. X-ray Diffraction